oct 2017

Scoring Indicators

SET- I

Code : TED (15) 3012

Version: 2015

Qn. No.	Scoring Indicators	Split score	Total score
	SURVEYING - II		
I	PART A		
1.	Transiting is the process of turning the telescope about its horizontal axis through 180° in a vertical plane thus bringing it upside down and making it point exactly opposite direction.	2	
2	The Latitude of a survey line is defined as its co-ordinate length measured parallel to an assumed meridian direction (ie along YY axis)	2	
3.	Stadia tacheometry and tangential tacheometry are the two methods in tacheometry	2	
4.	A non-circular curve of varying radius introduced between a straight and a circular curve for the purpose of giving easy changes of direction of a route is called a transition curve	2	
5.	The two types of photogrammetry are terrestrial photogrammetry and Aerial photogrammetry	2	10
II	PART - B		
1.	The temporary adjustments are made at each set up of the instrument before starting taking observations with the instrument. There are three temporary adjustments of a theodolite. ① Centering ② Levelling ③ Focussing.		

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	b) Centering: Centering means bringing the vertical axis of the theodolite immediately over a station mark. To do this, (a) Attach the string of the plumb-bob to the hook under the vertical axis of the instrument (b) Place the instrument over the station by spreading the legs well apart so that the telescope is at a convenient height, the plumb-bob is approximately over the station mark and the levelling head is approximately levelled. (c) Lift the instrument bodily without disturbing the relative positions of the legs and move it until the plumb-bob hangs within 1cm horizontally of station mark. (d) Unclamp the centre shifting arrangement and move the instrument until the plumb-bob is exactly over the station mark. The pointed end of the plumb-bob should hang within 3 mm vertically above the station mark. Then clamp the shifting head.	2	
	(2) Levelling: Having centered and approximately levelled the instrument, it is accurately levelled with reference to the plate levels by means of foot-screws. To level the instrument a) Loosen all clamps and turn the instrument about either of its axis until the longer -	2	

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	plate level is parallel to any pair of foot screws. b) Bring the long bubble to the centre of its run by turning both screws equally either both inward or both outwards. c) Similarly bring the other bubble to the centre of its run by turning only the third foot screw. d) Repeat this until both the bubbles are exactly centred. Now rotate the instrument about the vertical axis through a complete revolution. Each bubble will now remain central provided the plate levels are in correct adjustment. The vertical axis is thus made truly vertical. 3) Focussing: this is done in two steps. a) focussing the eye piece b) Focussing the object glass. a) focussing the eye piece: Point the telescope to the sky or hold a piece of white paper in front of the telescope. Move the eyepiece in and out a distant and sharp black image of the cross-hair is seen. b) focussing the object glass: Direct the telescope towards the object and turn the focussing screw until a clear and sharp image of object is obtained.	2	6

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11 2.	To measure the horizontal angle AOB by repetition method.  1) Set up the theodolite at station point O and level it accurately. (The face of the instrument should be left) 2) Set the vernier A to zero or 360° by using the upper clamp and its tangent screw. then loosen the lower clamp, direct the telescope to the left hand object (A) and bisect A exactly using the lower clamp and its tangent screw. 3) Check the reading of the vernier A and see whether it is still zero and then read the other vernier B. 4) Loosen the upper clamp, turn the telescope clock-wise and bisect the right hand object (B) exactly by using the upper clamp and its tangent screw. 5) Read both verniers. The object of reading the vernier is to obtain the approximate value of the angle. 6) Loosen the lower clamp and turn the telescope clockwise until the object (A) is sighted again. Bisect A accurately using the lower tangent screw. Check the vernier readings		

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	readings which must be the same as before. 7) Loosen the upper clamp, turn the telescope clockwise and again bisect towards B. Bisect B accurately by using the upper tangent screw. the vernier will now read twice the value of the angle. 8) Repeate the process until the angle is repeated the required number of times. (usually 3) Read both verniers. the final reading after 'n' repetitions should be approximately nx first reading. Divide the sum by the number of repetitions and the result thus obtained gives the correct value of the angle AOB. 9) Change the face of the instrument (now the face will be right) Repeat exactly in the same manner and find another value of the angle AOB. 10) the average of the two values of the angle thus obtained gives the required precise value of the angle AOB.	6	6
II 3.	Bowditch's Rule :- this rule is used to balance the traverse when the angular and linear measurements are equally precise. By this rule, the total error in latitude and that in departure is distributed in proportion to the lengths of the sides.	1	

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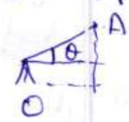
Qn. No.	Scoring Indicators	Split score	Total score
	Correction to latitude or departure of any side of a traverse $= \text{Total error in latitude or departure} \times \frac{\text{length of that side}}{\text{Perimeter of traverse}}$	2	
	Transit Rule:- This rule is used to balance the traverse when the angular measurements are more precise than the linear measurements.	1	
	i) Correction to latitude of any side $= \text{Total error in latitude} \times \left(\frac{\text{Latitude of that side}}{\text{Arithmetical sum of all latitudes}} \right)$ ii) Correction to departure of any side $= \text{Total error in departure} \times \frac{\text{departure of that side}}{\text{Arithmetical sum of all departures}}$	2	6
II 4.	To measure the vertical angle of an object A at a station O,  1) Set up the theodolite at station point O, and level it accurately with reference to the altitude bubble. 2) Set the zero of the vertical vernier exactly to the zero of the vertical circle by using the vertical clamp and tangent screw. 3) Bring the bubble of the altitude level in the central position by using the clip screw. The line of collimation thus made horizontal,		

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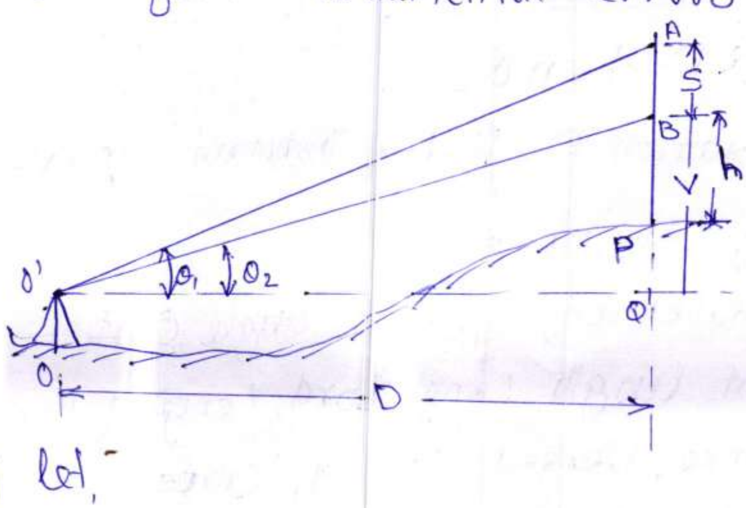
	while the vernier reads zero. 4) Loosen the vertical circle clamp screw and direct the telescope towards the object A and sight it exactly by using the vertical circle tangent screw. 5) Read both verniers on the vertical circle. The mean of the two vernier readings gives the value of the required angle 6) Change the face of the instrument and repeat the process. The mean of the two vernier readings gives the second value of the required angle. 7) The average of the two values of the angles thus obtained is the required value of the angle free from instrumental errors.	6	6
II 5.		2.	
	In fig let, O = the instrument station, O' = the position of instrument axis, P = the staff station $\angle AO'Q = \theta_1$ = Vertical angle to the upper vane		

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Qn. No.	Scoring Indicators	Split score	Total score
	$\angle BO'Q = \theta_2$ = vertical angle to the lower vane. $AB = S$ = the staff intercept $BQ = V$ = the vertical distance from the instrument axis to the lower vane. $O'Q = D$ = the horizontal distance from the instrument station O to the staff station P. $PB = h$ = the height of lower vane above the foot of the staff. Then $AQ = V+S = D\tan\theta_1$, $BQ = V = D\tan\theta_2$ $S = D(\tan\theta_1 - \tan\theta_2)$ $\therefore D = \dfrac{S}{(\tan\theta_1 - \tan\theta_2)}$ $V = D\tan\theta_2$ R.L of staff station P = R.L of Instrument axis + V − h.	4	6
II 6.	Elements of simple curve Angle of Intersection, Deflection angle, Central angle, Tangent length, Long chord, Length of Curve, Apex distance, Versed sine of curve	1x6 =6	6
II 7	The remote sensing applications are among several others cover different field such as forestry, agriculture, water resources ocean and marine sources, soil mapping, mapping of land use,	1x6 =6	

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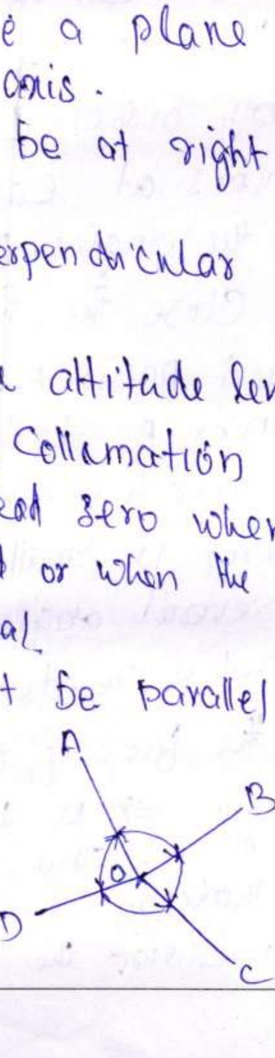
Qn. No.	Scoring Indicators	Split score	Total score
	management of waste land, monitoring of envirotmental hasards, water pollution, geology and mineral hazards.		6
	PART – C UNIT – I		
III a	Fundamental axes of a transit theodolite are 1) the vertical axis (2) the horizontal axis 3) Line of collimation (4) Axis of plate level (5) Axis of altitude level (6) Axis of striding level	½ × 6 = 3.	
	Desired relationship should exist 1. The axis of plate level must be a plane perpendicular to the vertical axis. 2. The line of collimation must be at right angles to the horizontal axis. 3. The horizontal axis must be perpendicular to the vertical axis 4. The axis of telescope level or the altitude level must be parallel to the line of collamation 5. The vertical circle verniers must read zero when the telescope level is centred or when the line of collimation is horizontal. 6. The axis of striding level must be parallel to the horizontal axis.	1 × 5 = 5	8
III b.	Suppose it is required to measure the angles AOB, BOC and COD. Then to measure the angle by reiteration method. 	1	

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	1) Set up the instrument over station point O and level it accurately. 2) Set the vernier A to 0° or 360° by using the upper clamp and its tangent screw. 3) Direct the telescope to the station point A. Bisect it accurately by using the lower clamp and its tangent screw. check the reading at vernier A, which should still be 0° or 360°. and note the reading at vernier B. 4) Loosen the upper clamp and turn the telescope clockwise until the point B is exactly sighted by using the upper tangent screw. Read both verniers. the mean of the two vernier readings will give the value of the angle AOB. 5) Similarly bisect C and D successively, read both verniers at each bisection. find the values of the angles BOC and COD. 6) finally close the horizon by sighting towards the station point A. 7) The vernier A should read 360°. If not, note down the error. this error occurs due to slip. 8) If the error is small, it is equally distributed among the several ~~angles~~ observed angles. If large a new set of readings be taken. 9) Change the face of the instrument 10). Set the vernier A to a reading other than 0° say 60° or 90°. this is done to avoid errors of graduation. 11) Again measure the angles in the same manner	6	

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Qn. No.		Scoring Indicators	Split score	Total score
		by turning the telescope this time in the Counter Clockwise direction to Compensate slip and errors due to twisting of the instrument. (2) Close the horizon and apply the necessary corrections to all the angles as before. (3) The mean of the two results for each angles is taken as its true value.		7
		OR		
IV	a.	By Repetition method the following errors are eliminated or minimised. 1). The errors due to the eccentricity of the centres and of the verniers are eliminated by reading both verniers and averaging the readings 2) The errors due to the imperfect adjustment of the line of collimation and the horizontal axis of the telescope are eliminated by face left and face right observations 3) The errors of graduations are minimised by measuring the angle on different part of the circle. 4) The errors in the pointings tend to compensate each other and the remaining errors are minimised by the division. 5) The error due to dislevelment of the bubble can be minimised by taking precautions in levelling.	Any 4 7	7

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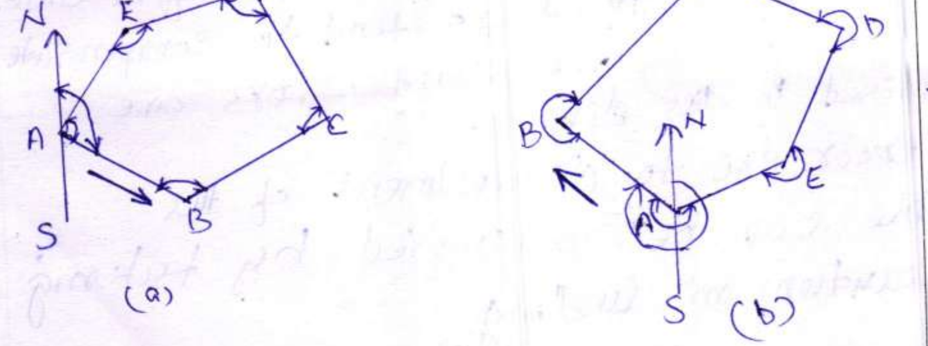
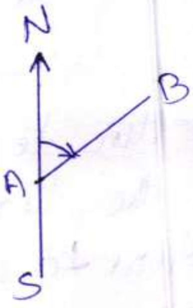
Qn. No.	Scoring Indicators	Split score	Total score
IV b.	To find the bearing of a line AB 1) Set up the instrument over A and level it accurately. 2) Set the vernier A to the zero of the horizontal circle. 3) Release the magnetic needle and loosen the lower clamp. 4) Rotate the instrument in the horizontal plane until the magnetic needle takes the normal position. Tighten the lower clamp and use its tangent screw for the exact coincidence. The line of sight is now parallel to the magnetic meridian and the vernier A reads zero. 5) Loosen the upper clamp. Turn the telescope and sight the object B, bisect B exactly by using the upper tangent screw. 6) Read both verniers on the horizontal circle. The mean of the two vernier readings gives the magnetic bearing of the line AB.	fig. 1 7	8
	UNIT-II		
V a.	 (a) (b) In a closed traverse, the angles measured	fig-1	



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	are either interior or exterior according as the traverse is run in a Counter-Clockwise direction (fig.a) or in a clockwise direction as in (fig b). The result is the same. The common practice is to run a closed traverse in a Counter clock wise direction.		
	Procedure:- In running a traverse ABCDE, the theodolite is set up over first station A and the bearing of the line AB is observed. The angle EAB is then measured by taking a backsight on the preceding station E and a fore sight on the forward station B, turning the clockwise direction. Both verniers are then read. The mean of the two vernier readings gives the required angle EAB. face left and face right observations are made. The theodolite is then moved to each of the successive stations B, C etc. and the angles ABC, BCD etc. are measured in a similar manner. The lines AB, BC etc. are measured with a tape. and the offsets necessary to locate the boundary and other details are taken in the usual way and recorded in the field book. Where great accuracy is required, the angles should be measured by repetition method.	6	7
V b.	The latitudes and departures of the known lines can be calculated as follows.		

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	Line AB = 345m N 45° E		
	latitude of AB = $l \cos\theta = 345 \times \cos 45° = +243.95$ m.	1	
	Departure of AB = $l \sin\theta = 345 \times \sin 45° = +243.95$ m		
	Line BC = 320m, S 45° E		
	latitude of BC = $l \cos\theta = 320 \times \cos 45° = -226.27$ m	1	
	Departure of BC = $l \sin\theta = 320 \times \sin 45° = +226.27$ m		
	Line CD = 210m, S 30° W		
	Latitude of CD = $l \cos\theta = 210 \times \cos 30° = -181.87$ m.		
	Departure of CD = $l \sin\theta = 210 \times \sin 30° = -105$ m.		
	for a closed traverse, $\Sigma L = 0$ and $\Sigma D = 0$.		
	Now Σ latitude known $= +243.95 - 226.27 - 181.87$		
	$\Sigma L = -164.19$ m.	1	
	Σ Departure known $= 243.95 + 226.27 - 105$		
	$\Sigma D = +365.22$ m.	1	
	latitude of DA = + 164.19 m.	1	
	Departure of DA = − 365.22 m.	1	
	Length of DA $= \sqrt{(164.19)^2 - (362.22)^2}$		
	$= 400.43$ m	1	
	Bearing of DA $= \frac{\Sigma D}{\Sigma L}$, $\tan\theta = \frac{\Sigma D}{\Sigma L}$		
	$\tan\theta = \frac{365.22}{164.19}$		
	$\theta = 65°47'$		
	Bearing of DA = N 65°47' W.	1	8
	W.C.B of DA = 294°13'		

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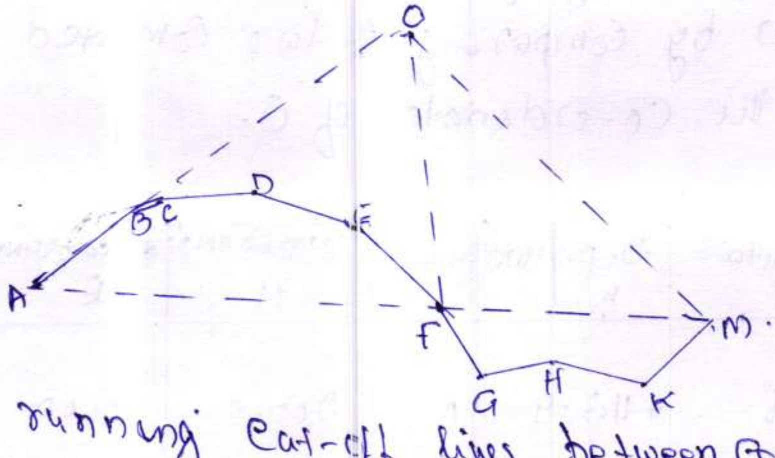
	OR.		
VI a	A series of survey lines, the last station being not connected with the first station, constitudes an open traverse.	1	
	Checks in open traverse:		
	1) The angular errors can be determined by astronomical observations for azimuth at regular intervals during the progress of survey.		
	2 		
	2.) By running cut-off lines between certain intermediate stations. Thus in fig. AF and FM are the cut-off lines. Both angular and linear measurements of the part of the traverse ABCDEF can be checked by observing the direction of AF both at A and F and seeing if the difference between these bearings is 180° and also by measuring distance AF. Similarly the part of the traverse from F to M can be checked by taking the fore and back bearings of the cut-off lines FM and measuring it.	2×3=6	
	3) By observing at intervals the bearing of		

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	a well-defined prominent object lying on one side of the traverse. thus in fig. the bearing of the object O is observed from stations A, F and M. The co-ordinates of O can be obtained from the observed measurements of the traverse ABCDEFO. Knowing the co-ordinates of O and M, the bearing of MO can be calculated. The traverse from A to M can be checked by comparing the computed bearing of MO with its observed bearing or by comparing the two computed values of the co-ordinates of O.		7
VI b.			

Line	Latitude m	Departure m.	Station	INDEPENDENT CO-ORDINATES N	E
AB	+204.6	+113.9	A	200.0	00.00
BC	-234.9	+205.8	B	404.6	113.9
CD	-150.7	-86.0	C	169.7	319.7
DA	+181.0	-233.7	D	19.0	233.7
			A	200	0.00.

Split score: 3

Arranging the co-ordinates in the determinant form

200	404.6	169.7	19.0	200
0.00	113.9	319.7	233.7	0.00

Split score: 1

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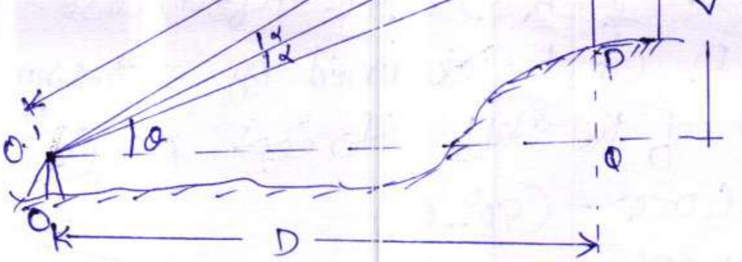
Qn. No.	Scoring Indicators	Split score	Total score
	$\Sigma P = 200 \times 113.9 + 404.6 \times 319.17 + 169.7 \times 233.7 + 19.00 \times 0.00$		
	$= 22780 + 129350 + 39658.89 + 0$		
	$= 191789.51$	1	
	$\Sigma Q = 0.00 \times 404.6 + 113.9 \times 169.7 + 319.7 \times 19.0 + 233.7 \times 200$		
	$= 0 + 19328.83 + 6074.3 + 46740$		
	$= 72143.13$	1	
	$\text{Area} = \frac{\Sigma P - \Sigma Q}{2}$	1	
	Twice area $= \Sigma P - \Sigma Q = 191789.51 - 72143.13$		
	$= 119646.38$		
	$\therefore$ Area of traverse $= \frac{119646.38}{2} = 59823.19 m^2$	1	8
	UNIT III		
VII a.		1	
	In fig, let		
	O = the instrument station		

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Qn. No.	Scoring Indicators	Split score	Total score
	O' = The position of instrument axis P = The staff station A, C, B = the points on the staff cut by the hairs of the diaphragm. $\angle CO'Q = \theta$ = the inclination to the line of sight to the horizontal AB = S = the staff intercept. O'C = L = the inclined distance along the line of sight O'Q = D = the horizontal distance from the instrument axis to the staff station QC = V = the vertical distance from the instrument axis to the point C. Through C draw A'B' perpendicular to O'C cutting O'A and O'B at A' and B'. The inclined distance L $L = \frac{f}{i}(A'B') + (f+d)$ from $\Delta O'CQ$ the required horizontal distance, $D = L\cos\theta = \frac{f}{i}(A'B')\cos\theta + (f+d)\cos\theta$ The value of D can be obtained by expressing A'B' in terms of the staff intercept AB (i.e. S) In $\Delta O'CQ$, $\angle O'CQ = (90^\circ - \theta)$ $\angle BCB' = \theta = \angle A'CA$ Let $\angle AO'C = \angle CO'B = \alpha$		

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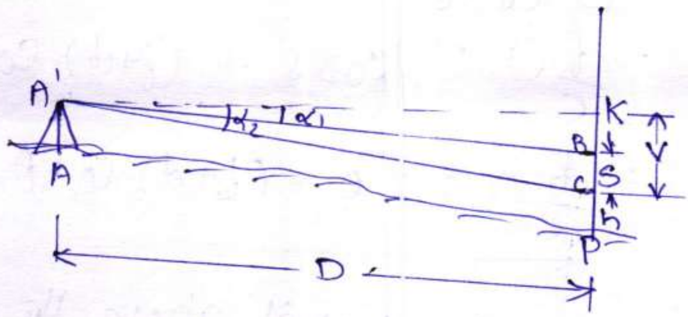
Qn. No.	Scoring Indicators	Split score	Total score
	The exterior angle AA'C of $\Delta A'O'C$ $= \angle A'CO' + \angle A'O'C = (90^\circ + \alpha)$ In $\Delta O'CB'$, $\angle O'CB' = 90^\circ$ $\therefore \angle CB'B = (90^\circ - \alpha)$ Thus in Δ^s AA'C and CB'B, angles AA'C and CB'B are equal to $(90^\circ + \alpha)$ and $(90^\circ - \alpha)$. The angle α being very small, angles AA'C and CB'B may be considered to be equal to 90°. $\therefore A'B' = AB\cos\theta = S\cos\theta$ $\therefore D = L\cos\theta$ $= \frac{f}{i}(A'B')\cos\theta + (f+d)\cos\theta$ $D = \frac{f}{i} S\cos^2\theta + (f+d)\cos\theta$	6	7
VII b.	h = height of the object above the instrument axis at A. $h = \frac{b\tan\alpha_2 + hd}{\tan\alpha_1 - \tan\alpha_2} \times \tan\alpha_1$ or $h = \frac{b + hd\cot\alpha_2 \tan\alpha_1 \tan\alpha_2}{(\tan\alpha_1 - \tan\alpha_2)}$	2	
	$\therefore hd = 1.222 - 0.862 = 0.36$.	1	
	$h = \frac{50 \times \tan 10^\circ 12' + 0.36}{\tan 18^\circ 36' - \tan 10^\circ 12'} \times \tan 18^\circ 36'$	1	

Code : **Version:**

<table>
<tr><th>Qn. No.</th><th>Scoring Indicators</th><th>Split score</th><th>Total score</th></tr>
<tr><td></td><td>$h = 20.008 m.$</td><td>2</td><td></td></tr>
<tr><td></td><td>Elevation of the top of the chimney
$= 421.380 + 0.862 + 20.008$
$= 442.242 m.$</td><td>2</td><td>8</td></tr>
<tr><td></td><td>OR</td><td></td><td></td></tr>
<tr><td>VIII a</td><td></td><td></td><td></td></tr>
<tr><td></td><td>
</td><td>2</td><td></td></tr>
<tr><td></td><td>$V = D \tan\alpha_2$ and $V - S = D \tan\alpha_1$
$\therefore S = D(\tan\alpha_2 - \tan\alpha_1)$
or $D = \frac{S}{(\tan\alpha_2 - \tan\alpha_1)}$</td><td>2</td><td></td></tr>
<tr><td></td><td>$V = D\tan\alpha_2 = \frac{S\tan\alpha_2}{(\tan\alpha_2 - \tan\alpha_1)}$</td><td>2</td><td></td></tr>
<tr><td></td><td>Elevation of staff station P
= Elevation of instrument axis − V − h</td><td>1</td><td>7</td></tr>
</table>

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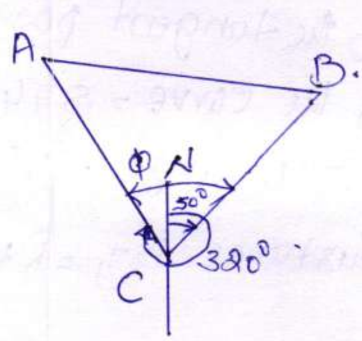
Qn. No.	Scoring Indicators	Split score	Total score
VIII	b. $D = \frac{f}{i} s \cos^2\theta + (f+d)\cos\theta$	1	
		fig. 1	
	CA = D_1 and CB = D_2		
	$S_1 = 2.550 - 0.906 = 1.644$		
	$S_2 = 3.654 - 0.744 = 2.910$		
	$D_1 = 100 \times 1.644 \times \cos^2 12^\circ = 157.24$ m.	1	
	$D_2 = 100 \times 2.910 \times \cos^2 10^\circ = 281.76$ m.	1	
	$\angle ACB = \phi$ = Bearing of CA − Bearing of CB $= (360^\circ - 320^\circ) + 50^\circ = 90^\circ$	2	
	In △ ACB		
	CA = 157.24, CB = ~~280~~ 281.76 and		
	$\angle ACB = 90^\circ$		
	Applying cosine rule for determination of AB		
	$AB^2 = 157.24^2 + 281.76^2 - 2 \times 157.24 \times 281.76 \times \cos 90^\circ$	1	
	$= 157.24^2 + 281.76^2$		
	AB = 322.66 m	1	8
	UNIT – IV		
IX	a The curves are classified as (1) simple curve (2) compound curve (3) Reverse curve (4) Transition curve.	1×3=3	3

Version:

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IX b.	Chainage of the tangent points T_1 and T_2		
	Radius of the curve = 574 m.		
	Deflection angle = 11°.		
	Tangent distance $BT_1 = R\tan\phi/2 = 574 \times \tan\frac{11^\circ}{2}$		
	$= 55.15$ m $= 1 + 25.15$	1	
	Length of curve $= \frac{\pi R \phi}{180} = \frac{\pi \times 574 \times 11}{180}$		
	$= 110.2$ m $= (3 + 20.2)$	1	
	Chainage of intersection point B = 80 + 17.00		
	Deduct tangent length BT_1 = 1 + 25.15		
	Chainage of point T_1 = 78 + 21.85	1	
	Add length of curve = 3 + 20.20		
	Chainage of point T_2 = 82 + 12.05	1	
	Length of first sub-chord T_1D = 8.15 m.	1	
	Length of last sub-chord = 12.05 m.	1	
	No. of unit chord = 3 Nos.	1	
	Deflection angle $\delta_n = \frac{1719\, c_n}{R}$	1	
	$\delta_1 = \frac{1719\, c_1}{R} = \frac{1719 \times 8.15}{574} = 0^\circ 24' 24''$		
	$\delta_2 = \frac{1719 \times 30}{574} = 1^\circ 29' 50''$	2	
	$\delta_2 = \delta_3 = \delta_4 = 1^\circ 29' 50''$		
	$\delta_5 = \frac{1719 \times 12.05}{574} = 0^\circ 36' 05''$		

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Code : Version:

Qn. No.	Scoring Indicators	Split score	Total score
	The total deflection angles are $\Delta_1 = \delta_1 = 0^\circ 24' 24''$ $\Delta_2 = \delta_1 + \delta_2 = 1^\circ 54' 14''$ $\quad 1^\circ 54' 20'' = 0^\circ 24' 20''$ $\Delta_3 = \delta_1 + \delta_2 + \delta_3 = 3^\circ 24' 12''$ $\quad 3^\circ 24' 20'' = 1^\circ 54' 20''$ $\Delta_4 = \delta_1 + \delta_2 + \delta_3 + \delta_4 = 4^\circ 54' 00'' = 3^\circ 54' 00''$ $\Delta_5 = \delta_1 + \delta_2 + \delta_3 + \delta_4 + \delta_5 = 5^\circ 30' 12'' = 5^\circ 30' 20''$	2	12
	OR		
X a	(1) optical sight, (2) Detachable carrying handle with mounting screw (3) objective with integrated EDM (4) Vertical drive (5) on/off key (6) Trigger key (7) Horizontal drive (8) focussing telescope image (9) eye piece (10) Battery cover (11) foot screw (12) Display (13) key board.	1×5=5	5
b.	Applications of G.I.S in civil Engg. are 1) Environmental planning 2) Local and municipal authorities 3) Transport planning 4) Public utilities.	5	5
c	Components of a G.P.S Receiver are 1. Antennas with preamplifier. 2. R.F section with signal identification		

Code :

Version:

Qn. No.	Scoring Indicators	Split score	Total score
	and signal processing. 3) Microprocessor for receiver control data sampling, data processing. 4) Precision oscillator 5) Power supply 6) User interface & Command & Display panel	1×5=5	5